We claim:

1. A DC-DC flyback converter having a main transformer, a DC input connection in a primary circuit connected with a primary winding of the main transformer, a controllable primary switch in series with the primary winding of the main transformer, said controllable primary switch having a primary control signal input connection for applying a first control signal in controlling relation to the controllable primary switch, a load connection in a secondary circuit connected with a secondary winding of the main transformer, a synchronous rectifier connected in series with the secondary winding and having a control connection for applying a second control signal to the synchronous rectifier in controlling relation to the synchronous rectifier, a control circuit connected between the control signal input connection for applying the first control signal to the controllable switch and the control connection for applying the second control signal to the synchronous rectifier control connection; the improvement comprising:

the control circuit comprising a logic circuit having a voltage derived from the first control signal as a first input and a voltage derived from a secondary winding of the main transformer as a second input, the logic circuit being responsive to the voltage derived from a secondary winding of the main transformer to turn ON the synchronous rectifier and being responsive to the voltage derived from the first control signal to turn OFF the synchronous rectifier.

2. The flyback converter according to claim 1, wherein the logic circuit is connected to have a voltage derived from the voltage across the synchronous rectifier as a third input.

3. The flyback converter according to claim 2, wherein the logic circuit comprises an AND gate, the AND gate having an input to which the voltage derived from the first control signal is applied, a first bistable circuit having an output applied as a second input to the AND gate, a second bistable circuit having an output applied as a third input to the AND gate, the voltage derived from a secondary winding of the main transformer being applied as an input to a first comparitor having an output connected as an input to the first bistable circuit, the voltage derived from the voltage across the

synchronous rectifier being applied as an input to a second comparitor having an output connected as an input to the second bistable circuit, and the first and second bistable circuits each having a further input to which is applied the voltage derived from the first control signal.

4. The flyback converter according to claim 3, wherein each of the first and second comparitors has a reference input set, in operation, at substantially 0 volts.

5. The flyback converter according to claim 3, wherein the first and second bistable circuits are first and second RS flip-flops, respectively, each having the voltage derived from the first control signal applied as an input to a "set" (S) input thereof, and the outputs of the first and second comparitors being applied respectively to "reset" (R) inputs of the first and second RS flip-flops, the first flip-flop having its "set" output (Q) applied as an input to the AND gate and the second flip-flop having its "reset" output $(\overline{Q})$ applied as an input to the AND gate.

6. A method of controlling conduction of a synchronous rectifier in a secondary circuit of a DC-DC flyback converter comprising:

(a) turning ON the synchronous rectifier in dependence on the establishment of a voltage across a secondary winding of a main transformer inductively coupling the secondary circuit to a primary circuit of the flyback converter, and

(b) turning OFF the synchronous rectifier in dependence on turning ON of a main switch in the primary circuit in current controlling relation to a primary winding of the main transformer.

7. The method according to claim 6, wherein step (b) comprises turning OFF the synchronous rectifier in dependence on a control signal turning ON the main switch.

8. The method according to claim 6, further comprising:

(c) providing a logic circuit connected with a control electrode of the synchronous rectifier,

(d) applying a voltage derived from the voltage across a secondary winding as one input to the logic circuit, and

(e) applying a voltage derived from a main switch control signal as a further input to the logic circuit.

9. The method according to claim 8, further comprising:

(f) applying a voltage derived from a voltage across the synchronous rectifier as a third input to the logic circuit.

10. The method according to claim 9, wherein step (c) comprises:

(i) supplying the voltage derived from a main switch control signal as an input to an inverter,

(ii) providing an output of the inverter as an input to an AND gate,

(iii) supplying the voltage derived from a main switch control signal as an input to each of a first and a second bistable circuit,

(iv) applying a further input to the first bistable circuit upon the detection of a voltage across the secondary winding of the main transformer,

(v) applying another input to the second bistable circuit upon the detection of a voltage across the synchronous rectifier,

(vi) applying one output of the first bistable circuit as a further input to the AND gate,

(vii) applying one output of the second bistable circuit as another input to the AND gate, and

(viii) applying the output of the AND gate to the control electrode of the synchronous rectifier as a control signal turning ON and OFF the synchronous rectifier.

11. The method according to claim 10, further comprising providing first and second RS flip-flops as the first and second bistable circuits.

12. The method according to claim 11, wherein step (c) (iii) comprises applying the voltage derived from the main switch control signal to a "set" (S) input of each of the first and second RS flip-flops, step (c) (iv) comprises applying the further input to a "reset" (R) input of the first RS flip-flop, step (c) (v) comprises applying the

another input to a "reset" (R) input of the second RS flip-flop, step (c) (vi) comprises applying a "set" (Q) output of the first flip-flop to the AND gate, and step (c) (vii) comprises applying a "reset" (R) output of the second flip-flop to the AND gate.

13. The method according to claim 6, wherein the secondary winding is a control secondary winding, steps (a) comprising providing in the main transformer a magnetic core having a center flux path and two outer flux paths, winding the control secondary winding on the two outer flux paths in current canceling relation as to flux conducted to the two outer flux paths from the center flux path, winding a control primary winding on at least one of the two outer flux paths, winding on the center flux path at least a main primary winding in energy communicating relation to a main secondary winding.

14. The method according to claim 13, further comprising winding the main secondary winding on the center flux path.

15. The method according to claim 13, wherein winding a control primary winding comprises winding the control primary winding on the two outer flux paths in flux canceling relation with respect to the center flux path.

16. The method according to claim 13, further comprising applying a control voltage developed in the control secondary winding to control the switching ON and OFF of the synchronous rectifier.

17. The method according to claim 13, further comprising applying to the control primary winding a differential signal developed by differentiation of a main switch control signal.

18. The method according to claim 13, wherein the main switch control signal is substantially a square wave and applying a differential signal to the control primary comprises providing a differentiating RC circuit at an input to the control primary winding and applying the main switch control signal to the differentiating RC circuit.

19. The method according to claim 18, wherein applying the control voltage developed in the control secondary comprises applying the control voltage to a switching circuit connected in controlling relation to the synchronous rectifier.

20. The method according to claim 19, wherein the switching circuit is a transistor switching circuit connected to a control electrode of the synchronous rectifier and further comprising deriving a DC bias, voltage from a secondary winding of the main transformer and applying the DC bias voltage to the transistor switching circuit.

21. The method according to claim 20, wherein the synchronous rectifier is a MOSFET switch and the transistor switching circuit is connected to a gate of the MOSFET switch.

22. The method according to claim 21, wherein the transistor switching circuit is a serially connected PNP and NPN transistor pair connected between the DC bias voltage and ground, a junction of the transistor pair being connected to the gate of the MOSFET switch.

23. A DC-DC flyback converter having a main transformer, a DC input connection in a primary circuit connected with a primary winding of the main transformer, a controllable primary switch in series with the primary winding of the main transformer, said controllable primary switch having a primary control signal input connection for applying a first control signal in controlling relation to the controllable primary switch, a load connection in a secondary circuit connected with a secondary winding of the main transformer, a synchronous rectifier connected in series with the secondary winding and having a control connection for applying a second control signal to the synchronous rectifier in controlling relation to the synchronous rectifier, a control circuit coupled between the primary control signal input connection and the control connection for applying the second control signal to the synchronous rectifier control connection, the improvement comprising:

the control circuit comprising a control primary winding and a control secondary winding wound on the main transformer, the control primary being connected in a circuit having an input from the primary control signal input connection, the control

secondary winding being connected in controlling relation to the control connection of the synchronous rectifier, the main transformer having a magnetic core with a center flux path on which is wound a main primary winding, and the magnetic core and having two outer flux paths on both of which is wound the control secondary winding, the control primary winding being wound on at least one of the outer flux paths, the control secondary winding being wound on the two outer flux paths in current canceling relation with respect to flux conducted to the two outer flux paths from the center flux path, whereby a control signal generated in the control secondary winding is substantially unaffected by flux developed in the main transformer by currents in the main primary winding.

24. The DC-DC flyback converter of claim 23, wherein the control primary winding is wound on both of the two outer flux paths in flux canceling relation with respect to the center flux path.

25. The DC-DC flyback converter of claim 23, wherein the control circuit further comprises a differentiation circuit coupled between the primary control signal input connection and the control primary winding.

26. The DC-DC flyback converter of claim 25, wherein the primary control signal input connection applies a signal that is substantially a square wave in controlling relation to the controllable primary switch and to the differentiation circuit, whereby the differentiation circuit applies an input signal to the control primary winding that is substantially the differential of a square wave.

27. The DC-DC flyback converter of claim 26, further comprising a switching circuit operatively connected to the control secondary winding and connected in controlling relation to the synchronous rectifier.

28. The DC-DC flyback converter of claim 27, wherein the switching circuit is a transistor switching circuit connected in controlling relation to a control electrode of the synchronous rectifier.

29. The DC-DC flyback converter of claim 28, further comprising a DC bias circuit connected to provide DC bias to the transistor switching circuit, the DC bias circuit comprising a secondary winding on the main transformer and at least one rectifying diode.

30. The DC-DC flyback converter of claim 29, wherein the synchronous rectifier is a MOSFET switch and the transistor switching circuit is connected to a gate of the MOSFET switch.

31. The DC-DC flyback converter of claim 30, wherein the transistor switching circuit is a serially connected PNP and NPN transistor pair connected between the DC bias voltage and ground, a point of interconnection of the transistor pair being connected to the gate of the MOSFET switch.

32. The DC-DC flyback converter of claim 31, wherein one side of the control secondary winding output is connected to the base of each of the PNP and NPN transistors and another side of the control secondary winding output is connected to the point of interconnection of the transistor pair.

33. A DC-DC flyback converter having a main transformer, a primary circuit including a controllable switch connected in current controlling relation to a primary winding and having a control connection for opening and closing the switch under the control of a first control signal, a secondary circuit for supplying an output to a load, and a synchronous rectifier having a control connection for opening and closing the synchronous rectifier, the improvement comprising:

a control circuit coupled between the control connections of the controllable switch and the synchronous rectifier comprising

(a) means for turning ON the synchronous rectifier in dependence on a voltage developed across a secondary winding on the main transformer, and

(b) means for turning OFF the synchronous rectifier in dependence on the first control signal turning ON the controllable switch.

34. The DC-DC flyback converter of claim 33, wherein the control circuit is a logic circuit having as a first input the first control signal and having as a second input the voltage developed in the secondary winding.

35. The DC-DC flyback converter of claim 33, wherein the control circuit includes a control primary winding wound on the main transformer in addition to main primary and secondary windings and coupled to the controllable switch control connection by a differentiating circuit and a control secondary winding wound on the main transformer in addition to the control primary winding and the main primary and secondary windings and coupled to the synchronous rectifier control connection.

36. A DC-DC flyback converter having a main transformer, a primary circuit including a controllable switch connected in current controlling relation to a primary winding and having a control connection for opening and closing the switch under the control of a first control signal, a secondary circuit for supplying an output to a load, and a synchronous rectifier having a control connection for opening and closing the synchronous rectifier, the improvement comprising:

(a) a control primary transformer winding,

(b) a differentiation circuit coupling the control primary transformer winding to the first control signal, and

(c) a control secondary transformer winding coupled to the synchronous rectifier control connection to turn ON at a time subsequent to opening of the controllable switch and to turn OFF the synchronous rectifier substantially concurrently with the closing of the controllable switch.

37. The DC-DC flyback converter of claim 36, wherein the control primary winding and the control secondary transformer windings are wound on a core of the main transformer.

38. A DC-DC converter having a main transformer, a DC input connection in a primary circuit connected with a primary winding of the main transformer, a controllable primary switch in series with the primary winding of the main transformer, said controllable primary switch having a primary control signal input connection for

applying a first control signal in controlling relation to the controllable primary switch, a load connection in a secondary circuit connected with a secondary winding of the main transformer, a synchronous rectifier connected in series with the secondary winding and having a control connection for inputting of a second control signal to the synchronous rectifier in controlling relation to the synchronous rectifier, a control circuit connected between the control signal input connection for applying the first control signal to the controllable switch and the control connection for inputting of the second control signal to the synchronous rectifier; the improvement comprising:

the control circuit having a rectified DC source including an auxiliary winding on the main transformer and a rectifier connected therewith for producing a DC voltage across a controlled transistor circuit, the controlled transistor circuit having a controlling input from a control circuit secondary transformer winding, a control circuit primary transformer winding inductively coupled to the control circuit secondary winding, and a derivative circuit connected between the primary control signal input connection and the control circuit primary winding, the derivative circuit being adapted to supply to the control circuit primary winding a derivative with time of the first control signal.